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Ministry of Forests

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OAF1 PROJECT REPORT

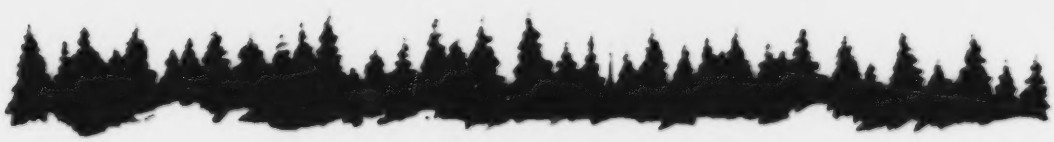
An Overview of Stocking Gaps and OAF1 Estimates for TIPSY

This is the first in a series of reports that provide information on the progress of the OAF1 Project. OAF1 is the Type 1 Operational Adjustment Factor used by the B.C. Ministry of Forests growth and yield model TIPSY (Table Interpolation Program for Managed Stand Yields). This report provides background information on stocking gaps, their effect on yield, the relation to TIPSY OAF1, and the benefits of obtaining improved estimates of OAF1. Detailed instructions on how to conduct the new ground-based silviculture survey for estimating OAF1 are provided in the second report in the series: **Ground-based survey method**. Subsequent reports will describe progress on other aspects of the project.

Introduction

Most TIPSY users input an OAF1 value of 15%. Until now, there has been no survey method for checking this assumed value.

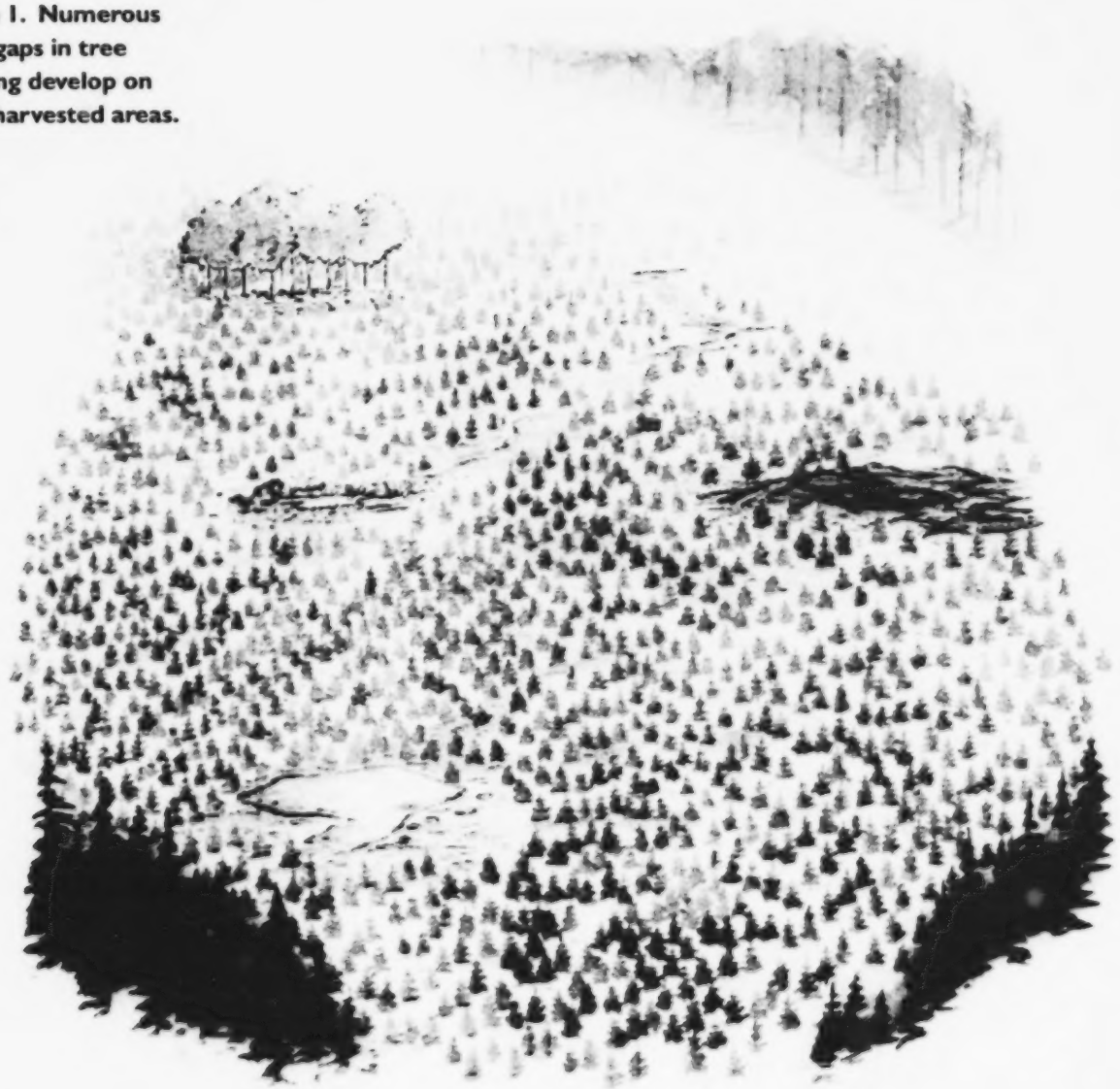
The OAF1 Project was initiated in 1996 with Forest Renewal B.C. funding in order to develop methods for obtaining estimates of OAF1 for TIPSY. OAF1 is a TIPSY input parameter that reduces yield to account for small stocking gaps in the stand (Mitchell and Grout 1995). Most TIPSY users apply a 15% OAF1 value to their TIPSY runs, thus reducing predicted yield by 15%. A recent review of assumptions used in timber supply analyses found that most analyses assumed an OAF1 of 15% (Winter 1997). This common assumption results in a substantial reduction in predicted yield; however, until now there has been no survey method for estimating OAF1 from the measurement of stocking gaps in individual stands.



Stocking Gaps

Disturbance type, ground conditions, regeneration method, and many other factors determine the spatial arrangement of young trees on a harvested area. Trees in young stands may become established in clumps, with unstocked gaps between them, or they may uniformly cover the harvested area. Stocking gaps develop where there are small pockets of regeneration failure, non-plantable spots due to slash or brush, planting gaps, or small areas of swamp, rock, or non-commercial cover (Figure 1). The number of stocking gaps in young stands varies greatly from stand to stand.

Figure 1. Numerous small gaps in tree stocking develop on most harvested areas.



Stocking gaps in young stands reduce the volume/ha produced by these stands at harvest (Figure 2).

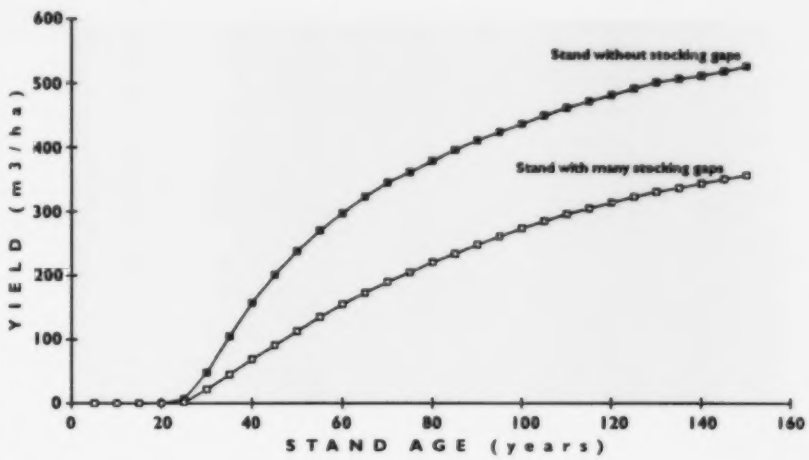


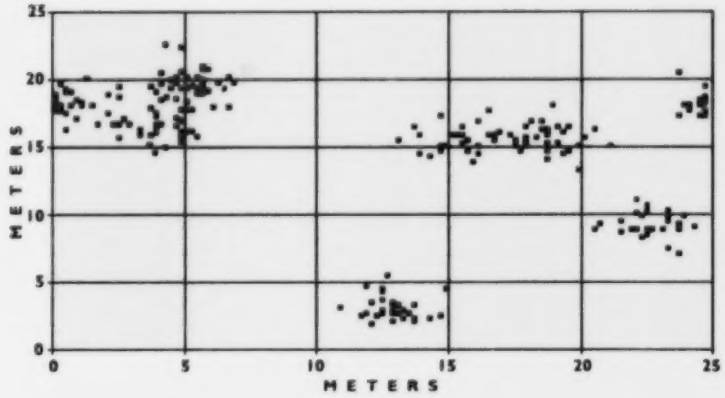
Figure 2. Future yield from a stand with stocking gaps and a comparable stand without stocking gaps.

Stocking Gaps and TIPSY OAF1

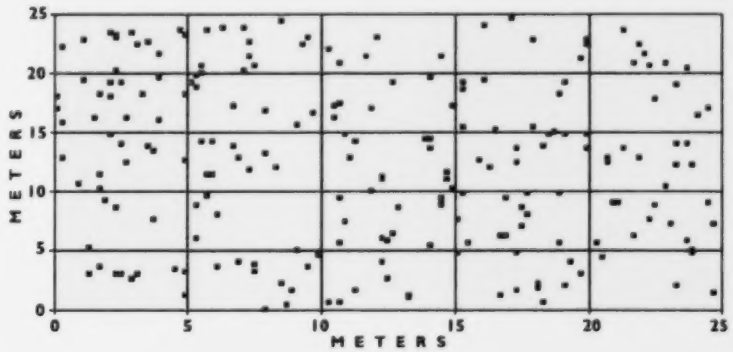
TIPSY assumes that, for each combination of stand density and origin (planted or natural), the trees on site are arranged in a specific spatial pattern. At low densities, TIPSY's initial spatial patterns contain stocking gaps. In some cases, stands established in large cut-overs contain more stocking gaps than TIPSY assumes. As a result, volume/ha yield at rotation will be less than TIPSY predicts. OAF1 is used to adjust TIPSY yield predictions to account for stocking gaps in addition to those TIPSY has already accounted for (Figure 3). Just as accurate site index and density estimates are essential TIPSY inputs, an appropriate OAF1 is required in order to obtain accurate yield predictions from TIPSY.

Figure 3. Example illustrating the relationship between stocking gaps and TIPSY OAF1.

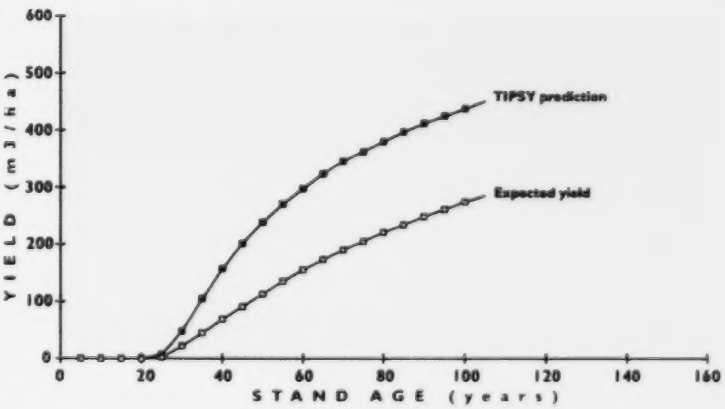
Polygon 1524 has 3455/ha naturally regenerated stems established in clumps, with numerous stocking gaps. Dots indicate tree location.



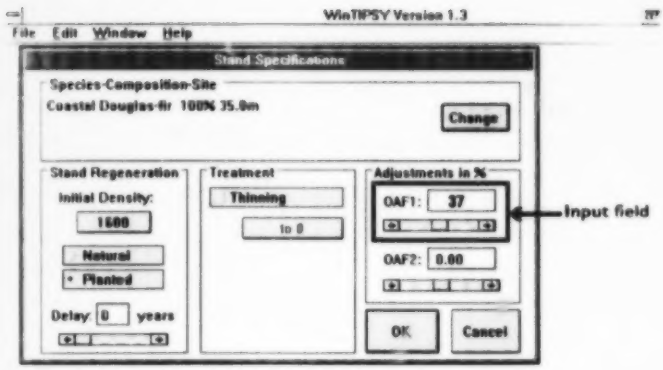
When generating a yield prediction for the same stand with 3455/ha naturally regenerated stems, TIPSY assumes a spatial pattern with fewer stocking gaps.



Due to the presence of numerous stocking gaps, the volume/ha at harvest in Polygon 1524 will be 37% less than the volume predicted by TIPSY.



By inputting OAF1=37% for the TIPSY run for Polygon 1524, the predicted merchantable volume/ha at rotation will be reduced by the exact amount required to account for the stocking gaps in the polygon.

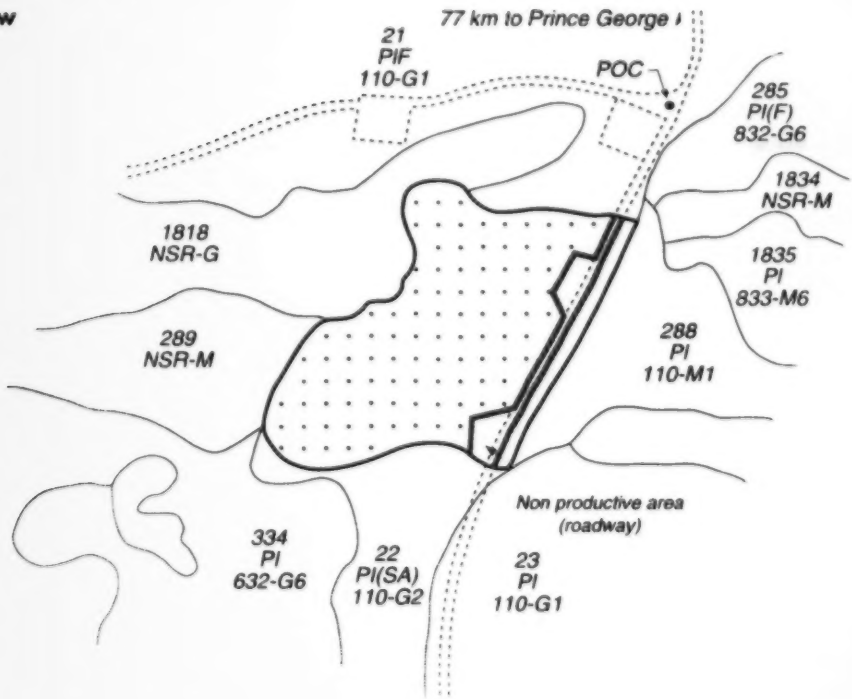


Note: The new version of WinTIPSY (Version 2.0) released in 1998 re-expresses OAF1 as a multiplier. For example, 10 becomes 0.9; 15 becomes 0.85, etc.

The New OAF1 Survey

A new survey has been developed to estimate the OAF1 required to reduce TIPSY predicted volume/ha to account for the small stocking gaps observed on an individual site (Figure 4). Detailed instructions on this silviculture survey method are provided in the second report in this series: Ground-based survey method.

Figure 4. The new OAF1 Survey



Benefits of Estimating OAF1

OAF1 values that are matched to the stand will improve the accuracy of yield tables produced from TIPSY, and the accuracy of all subsequent analyses that use these yield tables.

Now that a ground-based survey method is available, it is possible to obtain OAF1 input values appropriate for an individual site. An OAF1 input value that reflects the amount of stocking gaps on an individual site will make TIPSY yield predictions more accurate. The accuracy of all subsequent planning that utilizes these TIPSY yield predictions will be improved: timber supply analyses, inventory updates, the development of silviculture investment strategies, and prescriptions for individual stands.

With accurate OAF1 estimates, it is possible to evaluate the costs and benefits of forest practices that create stocking gaps.

Forest practices such as the harvesting system, the disposal of slash, and the method of regeneration will affect the spatial pattern of trees and the amount of stocking gaps in a stand. With accurate OAF1 estimates, it is possible to estimate the yield losses associated with these practices. Using these loss estimates, it is possible to compare costs with benefits and to identify economically viable opportunities for changing the practices that create small stocking gaps. Although stocking gaps reduce volume/ha yield, they provide non-timber benefits such as wildlife habitat and ecological diversity. With accurate OAF1 estimates, it is now possible to quantify the yield impact associated with providing these benefits.

Limitations

While OAF1 accounts for the effect on yields of small stocking gaps in the stand, it may be necessary to make additional reductions to TIPSY predictions to account for the effect of other factors such as insects, disease, damage, decay, waste, breakage, species mix, and so on.

Small stocking gaps are only one of the many reasons why the yields achieved under operational conditions may differ from those predicted by yield models like TIPSY. An improved estimate of OAF1 will account for the effect of stocking gaps, but it will not account for many other factors that can cause achieved yields to fall below TIPSY-predicted yields. These factors include:

1) biotic and abiotic damage agents such as insects, disease, wind, and snow;
2) decay, waste, and breakage at harvest;
3) the effect of species mixes.

OAF1 Project Team

The achievements of the OAF1 Project have been accomplished by the efforts of staff in the Ministry of Forests Forest Practices Branch and Research Branch, and the consulting firms of Laing and McCulloch Forest Management Services Ltd., Timberline Forest Inventory Consultants Ltd., and J. S. Thrower and Associates Ltd.

Where to Get More Information

To obtain additional copies of this report or to obtain copies of the other reports in this series, follow the instructions on the back of this document.
To discuss the OAF1 Project, contact:

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Literature Cited

Mitchell, KJ and SE Grout. 1995. WinTIPSY user's guide for producing managed stand yield tables with WinTIPSY version 1.3 under Microsoft Windows. B.C. Ministry of Forests, Research Branch, Victoria, B.C.

Winter, R. 1997. Assumptions included in timber supply analyses: Timber Supply Areas and Tree Farm Licences. B.C. Ministry of Forests, Forest Practices Branch, Victoria, B.C.

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